

CONTROL OF THE SPRUCE BEETLE INFESTATION

GYPSUM CREEK

BRIDGER NATIONAL FOREST, WYOMING

PLANS FOR 1956

By

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Entomologist

The Engelmann spruce beetle (Dendroctonus engelmanni Hopk.) on Gypsum Creek, Green River District, Bridger National Forest, was located by the annual aerial detection survey in early September 1955. The serious nature of the infestation was ascertained by ground observations and surveys that immediately followed the aerial survey. Data collected from these sources showed that a very serious epidemic of Engelmann spruce beetle was in progress and that immediate action would be required to control the infestation and utilize the "bug killed" timber.

The purpose of this report is to review progress to date, outline technical phases and provide guidelines on the techniques, and timing of control operations based on the seasonal history of the insect.

PROGRAM

After considerable deliberation and review by R. O. Timber staff, Bridger National Forest people, and forest entomologists of the Experiment Station, a program was developed to meet two objectives, (1) utilization of salvable material and (2) reduction of the bark beetle population. Emphasis is to be placed on logging the infested area. Logging offers these advantages: It costs less than any other known method of control; its roads make timber stands accessible for future harvest and protection from fire, insects, and diseases, and the spruce trees are put to commercial use. An accelerated harvesting program is essential if the beetle killed timber is to be utilized while it remains merchantable, and infested material removed rapidly from the stand in order to reduce the beetle population during the critical period. The requirements, both administrative and entomological, of the logging program have been described in detail in the sales contracts and will, of course, be directed by Bridger Forest personnel. Another phase of the Gypsum Creek project involves the use of trap trees. The purpose of the trap tree program is twofold: (1) to attempt to hold the infestation within

the present confines and (2) to reduce the loss until such time that all of the area can be logged. The trap tree technique is based upon the premise that Engelmann spruce beetle will attack felled trees in preference to standing trees. To be successful a trap tree must absorb many more beetles than normally attack a standing tree. In this case the sacrifice of one trap tree will save several standing trees. After trap trees have been attacked they must be moved from the woods by logging or treated with lethal sprays.

It is obvious that a successful project demands adequate, accurate, up-to-date insect and volume data. To obtain this information additional operational surveys will be necessary. It will also require considerable time of the entomologists in analyzing and interpreting the biological and operational influences that will affect the status of the infestation. Some of the more important items that can or will influence the spruce beetle epidemic are woodpeckers, insect predators, parasites, length and complexity of the beetle life cycle, climatic conditions (principally winter temperatures and snow depth) beetle population densities and host material supply. All of these items will have to be considered in connection with the progress, timing and methods employed in the logging and trap tree program. In order to fully evaluate the extent of the problem an aerial and ground detection survey will be conducted by the Division of Forest Insect Research on all adjoining Engelmann spruce stands during the early spring and summer months. As new areas are detected the insect situation will be appraised and an action program initiated if necessary. It may become desirable to treat the infested trees with toxic sprays on any infestation that cannot be logged.

Progress to Date

The infested area was cruised late in 1955 and timber sales were drawn up and advertised. The successful bidders, (Mills Lumber Company and Fall Creek Lumber Company) have been awarded the purchase of 47 million bd. ft. of timber. Cutting is scheduled to commence early in the spring of 1956. The first year's cutting will be concentrated in the heaviest areas of dead and infested timber. At the time that the timber cruise was being conducted, road engineers and surveyors began the initial work on laying out the necessary access roads. Approximately 2 weeks later heavy road equipment had moved in and construction was underway. Before the road crews were driven out by the winter weather about 6 miles of road was completed except for surfacing. In the meantime the entomologist, Richard I. Washburn, and the District Forest Ranger, Darrol Fluckiger, with the help of other key Bridger personnel formulated a definite trap tree program. On the 24th of October, the first traps began to fall and sufficient traps were felled (approximately 2200) in plenty of time to be covered with the heavy winter snows. These trees were felled in groups and arranged so that

the groups would fall roughly into defensive lines. One line runs from Gypsum Creek easterly towards the Green River at the point where the Gypsum Creek turns sharply to the east. The second line runs easterly from the Green River between Jim Creek and the South Fork (south end of infestation). The third and last line runs along the west edge of the timber type parallel to Gypsum Creek (west side of infestation).

1956 Project - Methods and Techniques

The program and progress has been outlined in the foregoing paragraphs. However, the entomological methods and techniques required to get the job done need further explanation.

The logging program, as has been stated, is described in detail in the sales contract and will be administered by the Bridger National Forest. The entomological considerations listed in the contract require that the contractor will store and mill the infested timber a sufficient distance from spruce stands to eliminate any threat that might be represented by a concentration of infested logs. The contractor may also be required to leave felled trees to serve as traps in the late fall, or any other time as determined by the entomologist. The contractor is further obligated to remove these trees as specified after "beetle fill-in" and before beetle flight from the traps.

A majority of the trap trees that were felled last fall are so situated that they can be removed by the loggers. Those that cannot be removed by the second week of September should be treated. Of course, as soon as it is possible to recognize that certain trap trees cannot be removed after "fill-in" they should be treated. The treating of infested trap trees or standing trees is accomplished by applying an ethylene dibromide emulsion. The spraying is done with the standard stirrup pump, hose, rods, and nozzles used on all bark beetle control jobs in the region. Details and specifications of equipment and insecticides are listed in the appendix under "Equipment." The entomologist will have to decide as the project progresses if additional trap trees should be felled by the forest to supplement the ones left by the logging operator.

APPENDIX

I Equipment and Supplies

Axes, hand (Tomahawk) with sheaths	12
Pumps, stirrup "Smith bucket" type, without hose or nozzle	8
Hose, 5/8" 2 braid neophreme	300 ft.
Fins-nozzles, Colo. fan spray type	24
Nozzles, No. 6, solid stream	24
Rods, spray, 6 ft. non-telescopic (may be obtainable from Dixie)	8
Rods, spray, 4 ft. curved	8
Connectors "Quick On" Truflate	
#101 female coupling 1/4"	12
#112 male end 1/4"	24
#312 male hose stems, 3/8" with pipe thread 1/4"	12
Wrenches, crescent, 6"	10
Graphite, string pump packing	(about) 100 ft.
Cans, Jeep (screw caps)	200
Saddles, pack, complete with saddle pads	16
Pads, protective insecticide	16
Can, oil, measuring - 1 Gal. capacity	1
Rags, clean	2 bundles
Insecticidal components	
ethylene dibromide, Tech grade (99.0%)	10,000 lbs.
fuel oil No. 1 or No. 2	approx. 3,300 gals.
emulsifier	
Triton X100 or equal	850 lbs.
Triton B1956 or equal	850 lbs.

The quantities are estimated on the theory that in any emergency project it is best to have an adequate supply plus an amount as a safety margin. Actually the quantities are based on the treatment of a combination of 1700 trap trees or standing trees.

II Mixing and Application of Insecticide

The standard 380 mixture should be used. The formula is as follows:

Stock solution (EDB emulsifiable concentrate)	
EDB (ethylene dibromide) tech. grade	3. lbs.
Emulsifier	
Triton X100	.25 "
Triton B1956	.25 "
Fuel oil to make	1 gal.

To make finished emulsion disperse 1 volume of stock solution into 4 volumes of water.

A workable formula for field use is:

EDB (90 lbs.)	1 Jeep can (5 gals.)
Triton X100 (7.5 lbs.)	about 1 gal.
Triton B1956 (7.5 lbs.)	about 1 gal.
(a suitable volume measure can be made from a one-gallon oil measure).	
Fuel oil	23 gals.

It is suggested that the mixing be done in 50 gallon drums that have had the bottoms removed. A suitable elbow of pipe and spigot should be threaded into the 3/4" spigot opening. The drums should be placed open side up on planks to protect the spigot. A mark is made on the inside of the drum at the 30-gallon level.

To mix field formula concentrate add roughly 1/2 of the fuel oil, pour in EDB and emulsifiers, fill to 30 gal. level with fuel oil. Stir the solution with a shovel and drain off in 1 gallon lots. Pour 1 gallon of the concentrate into each Jeep can. The 4 gallons of water should be added to each Jeep can shortly before the spray is to be applied. The mixture should be shaken to insure the formation of a good emulsion. The resultant emulsion should have a rich milky white creamy appearance. Finished emulsion should be used within a 48-hour period after addition of the water.

The finished emulsion should be applied to the infested boles in sufficient quantities to cause the emulsion to run. Care should be exercised to make certain that the under sides and hard to get at places of the down trees are thoroughly wetted.

Hazards Involved in The Use of Ethylene Dibromide

Ethylene dibromide in the concentrated form is extremely harmful to warm blooded animals. Men can be seriously affected by inhalation of the vapors, and their bodily contact with the liquid. Reasonable care will avoid these dangers.

In order to reduce the hazards to a minimum, a carefully chosen man, and trained assistants if necessary, who fully understands the hazards should be selected to mix or otherwise handle the EDB concentrate.

No one else should be allowed to come in contact with the tech. grade EDB or with the stock concentrate.

All mixing should be done outside.

A supply of rags and clean water should be on hand at mixing stations at all times.

No protective clothes are required.

Mixer must wash off spillage with clean water.

Any clothing that becomes contaminated should be removed and washed or aired.

Properly handled EDB is not dangerous but improperly handled it produces serious burns, sickness and even death.

The finished EDB emulsion as applied to the trees is relatively harmless. However, if confined for extended periods in the clothing it will cause some burning and irritation. To protect the treater:

A supply of clean rags and water should be carried by each crew.

Treaters should be instructed to avoid repeated exposure to spray drift and leakage.

All emulsions that reach the skin should be washed off immediately.

Treaters should have their clothing washed at least once a week--if an unusual amount is spilled on the clothing they should be removed immediately and washed.

IN GENERAL, WHENEVER HANDLING TOXIC CHEMICALS, IT IS GOOD BUSINESS TO BE OVERLY CAUTIOUS RATHER THAN TAKE A CHANCE.

HAZARD TO MEN ENGAGED IN SPRAYING SPRUCE
TREES WITH AN ETHYLENE DIBROMIDE EMULSION

CONCLUSIONS

1. The concentrations of Ethylene Dibromide found in the air were below 25 ppm, which is probably a satisfactory control figure for repeated eight-hour exposures.
2. Results of animal experiments indicate that vapor concentrations of a few hundred ppm of Ethylene Dibromide can cause systemic effects on single short exposures. If single exposures for less than 7 hours are kept below 100 ppm, no significant exposure is likely to result.
3. Skin contacts of more than a very few minutes duration with the emulsifiable concentrate are expected to result in local burns. Systemic effects may also occur if such contacts are at all extensive and prolonged.
4. If the 380 emulsion is held in contact with the skin, significant irritation (possible burns) are to be expected. There is also a possibility of significant skin absorption from continued contact with clothing which has become soaked with spray.
5. If all other skin surfaces are protected, there is little likelihood of skin irritation or absorption due to occasional exposure of the face to spray drift.

DISCUSSION

Air samples were taken while applying the 280 mixture (2 lb. EDB/5 gal.) 380 mixture (3 lb. EDB/5 gal.) and an oil solution containing 1-1/2 lb. EDB/5 gal. There seems to be no noticeable difference in exposure of operators while handling the various mixtures. There was no significant variation between results obtained by using an absorber and those obtained by means of an impinger. This indicates that the inhalation hazard is likely to be due to vapor rather than small drops. These samples were taken during quite cold weather and it is likely that somewhat greater values would be obtained at higher temperatures. The concentrations shown in the table may be compared with 25 ppm which is thought to be a satisfactory control figure for repeated eight-hour exposures. It should be remembered that exposure to a few hundred ppm of Ethylene Dibromide for single exposures of one hour or more are likely to result in adverse effects. No significant exposure is likely if single exposures are kept below 100 ppm.

A sample of the concentrate, when applied to the skin of rabbits resulted in burns and death of the animals within 24 hours. The 380 mixture, when bandaged onto the rabbit's skin, caused severe irritation.

(Over)

The same mixture, when applied to the uncovered ear, was slightly irritating. These results would indicate that the emulsifiable concentrate must be kept off the skin by the use of suitable protective equipment. In the event of accidental contact, the concentrate must be washed off immediately. Ordinary clothing, which covers the skin except for the face, is evidently adequate protection during the spraying operation, provided the clothing is not allowed to wet through. Oil soaked clothing should, of course, not be worn. It appeared that gloves and caps are most likely to become soaked during the spraying operation.

CONCENTRATIONS OF ETHYLENE DIBROMIDE
FOUND IN AIR WHILE SPRAYING TREES WITH
ETHYLENE DIBROMIDE MIXTURE

<u>Sample</u>	<u>Description</u>	<u>Concentration parts per million</u>
929 and 127	General atmosphere immediately following spraying. Trees in the area being sprayed nearby. Some odor of EDB and oil detectable	3.5; 8.2
143 and 214	Same area as No. 929 sample taken 24 hours later and after a heavy rain. No odor	2.9; nil.
103	Breathing zone of operator while spraying 280 mixture	17
171; 63 54; 149; 53; 57	Breathing zone while spraying with 380 mixture	8.2; 14; 11.4; 15; 9.5; 7.1
58 50	Breathing zone while applying oil solution	5.5; 7.9

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Typical mixing station used to formulate ethylene dibromide.
water in oil emulsion stock solution.

- a. Mixing drums (open end)
- b. Drums Tech. grade EDB
- c. Drums, emulsifier (one Triton X100, one Triton B1956)
- d. Fuel oil
- e. Jeep cans, empty
- f. Jeep cans containing one gal. of stock



Example of method of packing EDB emulsion and spray apparatus.



Application of EDB emulsion to unsprayed top.

TRAP TREE SCHEDULE

Gypsum Cr. Control Project

Carl Grossenbach.

Here is Carl's write up of guide lines on the
Sycamore Creek job.

I wonder if it might not be a good idea
for your office to send them to the Budget
thereby signifying that your office has
had a chance to pass on them.

We have attached 1 for your drop, 2 for
the Forest, and 2 if the Forest feels that
it might be a good start to acquaint
the agents that are to do the logging
with the facts behind the job.

Don Parker